SECTION IV.—RIVERS AND FLOODS.

RIVERS AND FLOODS, NOVEMBER, 1916.

By ALFRED J. HENRY, Professor in Charge.

[Dated: Weather Bureau, Washington, Jan. 2, 1917.]

The year 1916 came to a close without floods of any consequence during the months of October and November. The precipitation of October and November was not sufficiently intense nor so widely distributed as to produce high stages in the streams.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

SIX YEARS OF SNOWFALL MEASUREMENTS IN THE CARSON, WALKER, AND TRUCKEE WATERSHEDS.

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[Dated: Weather Bureau Office, Reno, Nev., Sept. 23, 1916.]

The chief object of this paper is to show in what manner and to what extent the seasonal snowfall decreases in the watersheds of the Carson and Walker Rivers, as compared with the snowfall in the Truckee Basin. Thus we lay a foundation for correlating the available data on precipitation over the two watersheds first mentioned, with the stream-flow measurements made by the Government at stations located near their headwaters, and may be able eventually to predict their respective run-offs from our knowledge of the snowfall percentage relationships thus established.

In view of the fact that complete snowfall records are available for only a few Weather Bureau mountain-snowfall stations in these districts, no *quantitative* values as to the entire snow cover could be computed. By carefully scrutinizing and summarizing the data given in Tables 1–3 we can get a fairly accurate notion of the relative or percentage distribution of the precipitation in the several watersheds.

Some data as to altitude and depth of snow may prove of interest to the student.

In 1915 the author worked out a percentage relationship between the snowfall and run-off for the Tahoe Basin which has enabled us to forecast the run-off in Lake Tahoe for the season of 1916; therefore it seems reasonable to expect that whenever stream-flow data for the Carson and Walker Rivers become available we may do the same for those streams.

The snowfall values given below are of the kind which J. E. Church, jr., properly has termed "symptomatic." For example, in the Tahoe Basin the average snowfalls for the seasons of 1910–11 and 1911–12 were 320 and 150 inches, respectively. Regardless of such other considerations as water content, relative density, watershed areas, etc., there can be but one logical deduction from a comparison of these values, namely, that the first-named season was one of very heavy snows while the second was a very dry season. The percentages given also help in contrasting the two seasons.

The stations selected for this study are representative ones in so far as any choice was permissible, and the region within which they are situated is a quadrilateral in the Sierra Nevada about 49 by 56 miles, whose northern limit lies in latitude 39° 10′ N. and the eastern limit in longitude 119° 14′ W. Three of the stations—Tahoe, McKinney, and Bijou—are on the shores of Lake Tahoe; Marlette Lake, the highest station (7,900 feet), is on the southern shore of the small lake in Nevada bearing that name; the lowest station, Shields ranch (5,300 feet), is but a short distance west of the Nevada-California boundary.

The seasonal snowfall in the three watersheds is strongly contrasted by means of Table 1. The depth of the snow cover decreases rapidly as we travel southward from the Tahoe watershed, as plainly indicated by the six and seven year averages given in Table 1.

The greater elevation of the Tahoe basin, and the presence therein of a large lake which never freezes over, would account in a large measure for the relatively heavier snows in that region. It seems that in the case of the Carson and Walker Basins, however, some factor other than a difference of altitude must be the controlling influence that causes a markedly smaller snowfall in the Walker Basin, since the average elevation of the latter is the greater by some 320 feet. This factor evidently is both geographic and climatic, for the Walker Basin lies farther to the east and south, and the annual isohyets for eastern California and for Nevada plainly show that normally there is a considerable diminution of precipitation eastward from the summit of the range at all points in the same latitude. Again, the Walker watershed is farther away from the normal path of the Pacific coast cyclonic system.

It is noteworthy that during the last six years the minimum snowfall for that period was recorded in all basins in the same season, namely, that of 1911–12. No such uniformity of distribution, however, is disclosed as to the maximum amounts of snowfall; the season of deepest snows in the Tahoe watershed was that of 1910–11, and in the other watersheds, that of 1915–16. Comparing the "per cent of average" values given in Table 1 with one another, we note a wide variation in the snowfall percentage relationships between the several basins. In some seasons the snow was *relatively* heavier in the Walker Basin, and, in other seasons, lighter than in the Tahoe Basin, from which fact we are tempted to make the deduction, namely, that these variations were due to northward and southward deflections of the Pacific coast barometric depressions, from the normal storm path, in different seasons.

The question, How does the snowfall at different points in the same climatic zones increase with elevation? is of general interest. We have made some computations, the results of which are given in Table 2. The stations chosen for comparisons, as grouped, do not differ very much as to latitude, and have much in common as ot climate, as modified, of course, by altitude.

The snowfall in the Walker and the Truckee-Tahoe watersheds increases with altitude at the rate of about 18 inches for every 100 feet increase in elevation; from Reno to Summit the rate is slightly less, but from Truckee westward it is slightly over 18 inches. On the west slope